AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

1. (Currently Amended): A method of determining a permittivity of a dielectric layer of a semiconductor wafer comprising:

(a) providing a means for contacting a topside of a semiconductor wafer, the contact means including at least a partially spherical surface formed from a conductive material;

(b) determining a thickness of a dielectric layer on the semiconductor wafer having semiconducting material underlying the dielectric layer;

(c) causing the at least partially spherical surface of the contact means to contact the topside of the semiconductor wafer thereby defining a capacitor, wherein the capacitance of the capacitor is comprised of a first capacitance resulting from materials in alignment with a contact area of the contact means in contact with the top surface of the semiconductor wafer and a second capacitance resulting from materials in alignment with a gap defined between the top surface of the semiconductor wafer and a surface of the contact means not in contact with the top surface surrounding the contact area;

(d) applying an electrical stimulus to the contact means and the semiconducting material when the capacitor is defined;

(e) determining ~~a~~ the capacitance of the capacitor from the response thereof to the applied electrical stimulus; and

(f) determining a permittivity of the dielectric layer as a function of the capacitance determined in step (e), the thickness of the dielectric layer determined in step (b) and the thickness of ~~a~~ the gap ~~between the surface of the contact means and the topside of the semiconductor wafer adjacent where the surface of the contact means contacts the topside of the semiconductor wafer~~ surrounding the contact area.

2. (Original): The method of claim 1, wherein the topside of the semiconductor wafer comprises at least one of:

a surface of the dielectric layer opposite the semiconducting material; and

a surface of organic(s) and/or water overlaying the surface of the dielectric layer opposite the semiconducting material.

3. (Original): The method of claim 1, further including desorbing at least one of water and organic(s) from a surface of the dielectric layer.

4. (Original): The method of claim 1, wherein the at least partially spherical surface is formed from a conductive material that either does not form an oxide layer or forms a conductive oxide on the surface thereof.

5. (Cancelled)

6. (Currently Amended): The method of claim 2, wherein the permittivity of the dielectric layer (ε_{ox}) is determined utilizing the formula:

$$C = \varepsilon_0 A[(T_p/\varepsilon_p) + (T_{ox}/\varepsilon_{ox}) + (T_{org}/\varepsilon_{org})]^{-1} + 2\pi\varepsilon_0\varepsilon_{H_2O} R \ln\left[\frac{(T_p/\varepsilon_p) + (T_{ox}/\varepsilon_{ox}) + (T_{org}/\varepsilon_{org}) + (T_{H_2O}/\varepsilon_{H_2O})}{(T_p/\varepsilon_p) + (T_{ox}/\varepsilon_{ox}) + (T_{org}/\varepsilon_{org})}\right] + 2\pi\varepsilon_0 R \ln\left[\frac{(T_p/\varepsilon_p) + (T_{ox}/\varepsilon_{ox}) + (T_{org}/\varepsilon_{org}) + (T_{H_2O}/\varepsilon_{H_2O}) + (T_{gap})}{(T_p/\varepsilon_p) + (T_{ox}/\varepsilon_{ox}) + (T_{org}/\varepsilon_{org}) + (T_{H_2O}/\varepsilon_{H_2O})}\right]$$

where C = the capacitance determined in step (e);

ε_0 = permittivity of free space;

A = contact area of the contact means in contact with the topside of the semiconductor wafer;

R = radius of curvature of the contact means;

ln= natural log;

T_p = thickness of an oxide layer (if any) on the surface of the contact means;

ε_p = permittivity of the oxide layer;

T_{ox} = thickness of the dielectric layer;

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ε_{ox} = permittivity of the dielectric layer;

T_{org} = thickness of the organic(s) (if any) overlaying the dielectric layer;

ε_{org} = permittivity of the organic(s);

T_{H_2O} = thickness of the water (if any) overlaying the dielectric layer;

ε_{H_2O} = permittivity of the water; and

T_{gap} = thickness of the gap ~~between the surface of the contact means and the topside of the semiconductor wafer adjacent where the surface of the contact means contacts the topside of the semiconductor wafer~~ surrounding the contact area.

7. (Currently Amended): A system for determining a permittivity of a dielectric layer of a semiconductor wafer comprising:

means for contacting a topside of a semiconductor wafer, the contact means including at least a partially spherical surface formed from a conductive material;

means for determining a thickness of a dielectric layer on the semiconductor wafer having semiconducting material underlying the dielectric layer;

means for moving the topside of the semiconductor wafer and the at least partially spherical surface of the contact means into contact thereby defining with the dielectric layer a capacitor having a capacitance comprised of a first capacitance resulting from materials in alignment with a contact area of the contact means in contact with the top surface of the semiconductor wafer and a second capacitance resulting from materials in alignment with a gap defined between the top surface of the semiconductor wafer and a surface of the contact means not in contact with the top surface surrounding the contact area;

means for applying an electrical stimulus to the contact means and the semiconducting material when the capacitor is defined; and

means for determining a capacitance of the capacitor from the response of the capacitor to the applied electrical stimulus; and

means for determining a permittivity of the dielectric layer as a function of the capacitance, the thickness of the dielectric layer and a thickness of ~~a~~ the gap ~~between the surface of the contact means and the topside of the semiconductor wafer adjacent where the surface of the contact means contacts the topside of the semiconductor wafer~~ surrounding the contact area.

8. (Original): The system of claim 7, wherein the topside of the semiconductor wafer comprises at least one of:

a surface of the dielectric layer opposite the semiconducting material; and

a surface of organic(s) and/or water overlaying the surface of the dielectric layer opposite the semiconducting material.

9. (Original): The system of claim 7, further including means for desorbing at least one of water and organic(s) from a surface of the dielectric layer.

10. (Original): The apparatus of claim 7, wherein the at least partially spherical surface is formed from a conductive material that either does not form an oxide layer or forms a conductive oxide on the surface thereof.

11. (Cancelled)

12. (Currently Amended): The system of claim 11, wherein the means for determining the permittivity of the dielectric layer utilizes the formula:

$$C = \varepsilon_0 A[(T_p/\varepsilon_p) + (T_{ox}/\varepsilon_{ox}) + (T_{org}/\varepsilon_{org})]^{-1} +$$

$$2\pi\varepsilon_0\varepsilon_{H_2O}R\ln\left[\frac{(T_p/\varepsilon_p) + (T_{ox}/\varepsilon_{ox}) + (T_{org}/\varepsilon_{org}) + (T_{H_2O}/\varepsilon_{H_2O})}{(T_p/\varepsilon_p) + (T_{ox}/\varepsilon_{ox}) + (T_{org}/\varepsilon_{org})}\right] +$$

$$2\pi\varepsilon_0 R\ln\left[\frac{(T_p/\varepsilon_p) + (T_{ox}/\varepsilon_{ox}) + (T_{org}/\varepsilon_{org}) + (T_{H_2O}/\varepsilon_{H_2O}) + (T_{gap})}{(T_p/\varepsilon_p) + (T_{ox}/\varepsilon_{ox}) + (T_{org}/\varepsilon_{org}) + (T_{H_2O}/\varepsilon_{H_2O})}\right]$$

where C = the capacitance determined in step (e);

ε_0 = permittivity of free space;

A = contact area of the contact means in contact with the topside of the semiconductor wafer;

R = radius of curvature of the contact means;

ln= natural log;

T_p = thickness of an oxide layer (if any) on the surface of the contact means;

ε_p = permittivity of the oxide layer;

T_{ox} = thickness of the dielectric layer;

ε_{ox} = permittivity of the dielectric layer;

T_{org} = thickness of the organic(s) (if any) overlaying the dielectric layer;

ε_{org} = permittivity of the organic(s);

T_{H_2O} = thickness of the water (if any) overlaying the dielectric layer;

ε_{H_2O} = permittivity of the water; and

T_{gap} = thickness of the gap ~~between the surface of the contact means and the topside of the semiconductor wafer adjacent where the surface of the contact means contacts the topside of the semiconductor wafer~~ surrounding the contact area.

13. (Currently Amended): A method of determining a permittivity of a dielectric layer of a semiconductor wafer comprising:

(a) determining a thickness of the dielectric layer overlaying semiconducting material of a semiconductor wafer;

(b) moving a topside of the semiconductor wafer and a spherical portion of an at least partially spherical and electrically conductive surface into contact;

(c) applying an electrical stimulus between the electrically conductive surface and the semiconducting material;

(d) determining from the applied electrical stimulus a capacitance of a capacitor ~~comprised of the electrically conductive surface and the semiconducting material~~ comprised of a first capacitance resulting from materials in alignment with a contact area of the contact means in contact with the top surface of the semiconductor wafer and a second capacitance resulting from materials in alignment with a gap between the top surface and the contact means surrounding the contact area; and

(e) determining a permittivity of the dielectric layer as a function of the capacitance determined in step (d), the thickness of the dielectric layer determined in step (a) and a thickness of ~~a~~ the gap ~~between the electrically conductive surface and the topside of the~~

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~~semiconductor wafer adjacent where electrically conductive the surface contacts the topside of the semiconductor wafer~~ surrounding the contact area.

14. (Original): The method of claim 13, wherein the topside of the semiconductor wafer comprises at least one of:

a surface of the dielectric layer opposite the semiconducting material; and

a surface of organic(s) and/or water overlaying the surface of the dielectric layer opposite the semiconducting material.

15. (Original): The method of claim 13, further including, prior to step (b), desorbing at least one of water and organic(s) from a surface of the dielectric layer.

16. (Original): The method of claim 13, wherein the electrically conductive surface is formed from a material that either does not form an oxide layer thereon or forms a conductive oxide thereon.

17. (Cancelled)

18. (Currently Amended): The method of claim 13, wherein the permittivity of the dielectric layer (ε_{ox})

is determined by solving the following formula for ε_{ox}:

$$C = \varepsilon_0 A[(T_p/\varepsilon_p) + (T_{ox}/\varepsilon_{ox}) + (T_{org}/\varepsilon_{org})]^{-1} +$$

$$2\pi\varepsilon_0\varepsilon_{H_2O}R\ln\left[\frac{(T_p/\varepsilon_p) + (T_{ox}/\varepsilon_{ox}) + (T_{org}/\varepsilon_{org}) + (T_{H_2O}/\varepsilon_{H_2O})}{(T_p/\varepsilon_p) + (T_{ox}/\varepsilon_{ox}) + (T_{org}/\varepsilon_{org})}\right] +$$

$$2\pi\varepsilon_0 R\ln\left[\frac{(T_p/\varepsilon_p) + (T_{ox}/\varepsilon_{ox}) + (T_{org}/\varepsilon_{org}) + (T_{H_2O}/\varepsilon_{H_2O}) + (T_{gap})}{(T_p/\varepsilon_p) + (T_{ox}/\varepsilon_{ox}) + (T_{org}/\varepsilon_{org}) + (T_{H_2O}/\varepsilon_{H_2O})}\right]$$

where C = the capacitance determined in step (e);

ε_0 = permittivity of free space;

A = contact area of the contact means in contact with the topside of the semiconductor

wafer;

R = radius of curvature of the contact means;

ln = natural log;

T_p = thickness of an oxide layer (if any) on the surface of the contact means;

ε_p = permittivity of the oxide layer;

T_{ox} = thickness of the dielectric layer;

ε_{ox} = permittivity of the dielectric layer;

T_{org} = thickness of the organic(s) (if any) overlaying the dielectric layer;

ε_{org} = permittivity of the organic(s);

T_{H_2O} = thickness of the water (if any) overlaying the dielectric layer;

ε_{H_2O} = permittivity of the water; and

T_{gap} = thickness of the gap ~~between the electrically conductive surface and the topside of the semiconductor wafer adjacent where the electrically conductive surface contacts the topside of the semiconductor wafer~~ surrounding the contact area.